430, **630**) may be in the range from about 0.05 mm to about 5 mm, and in one embodiment about 0.2 mm to about 2 mm.

[**0152**] The capture structures may comprise any structure that captures liquid and permits vapor to flow through it. Alternatively, the capture structure may not permit vapor flow throughout but be aligned adjacent to the vapor flow. The capture structures may comprise a wire mesh or projecting surface features or cones. The capture structure may comprise inverted cones, liquid-nonwetting porous structures, liquid-wetting porous structures, and/or fibers such as found in demisters or filter media. The capture structure may comprise one or more of sintered metal, metal screen, metal foam, and polymer fibers. Mechanisms for capturing dispersed liquid particles include impingement (due to flow around obstructions), Brownian capture (long residence time in high surface area structure), gravity, centrifugal forces (high curvature in flow), or incorporating fields, such as electrical or sonic fields, to induce aerosol particle motion relative to the flow field.

[**0153**] In one embodiment, the capture structures may comprise perforated foil, for example, a perforated foil in the form of expanded tetrahedrally configured filaments. Examples include Delker expanded screens such as 10 AL 16-125 P and 5 Cu 14-125 P. These screens can have one or two orders of magnitude higher permeability than conventional woven screens. In addition, aluminum, copper, and other metal forms of these screens have relatively high thermal conductivities and also enhance heat transfer.

[**0154**] Another use for the capture structure may be to enhance heat transfer. If the capture structure has a high thermal conductivity, it can act as an extended surface for heat transfer. By being in thermal contact with heat exchange channels, the capture structure may promote heat transfer between the heat exchange channel and the liquid and vapor phases in the microchannel distillation unit.

[**0155**] The wicking region may comprise a wick and/or a wicking surface. The wicking region may preferentially retain a wetting fluid by capillary forces. The wicking region may comprise multiple continuous channels or grooves through which liquids may travel by capillary flow. The channels or grooves may be regularly or irregularly shaped. Liquid may migrate through a dry wick, while liquid in a liquid-containing wick can be transported by gravitational force or by applying a pressure differential, to the wick. The capillary pore size in the wicking material may be selected based on the contact angle of the liquid, the intended pressure gradient within the liquid channel and the surface tension of the liquid.

[**0156**] The wick in the wicking region may be made of different materials depending on the liquid that is intended to be transported through the wicking region. The wicking material may be a uniform material, a mixture of materials, a composite material, or a gradient material. For example, the wicking material may be graded by pore size or wettability to help drain liquid in a desired direction. Examples of wicking materials that may be used include: sintered metals, metal screens, metal foams, polymer fibers including cellulosic fibers, as well as other wetting porous materials. The capillary pore or opening sizes in the wicking materials may be in the range of about 10 nm to about 2 mm, and in one embodiment about 100 nm to about 0.1 mm, where these sizes are the largest pore diameters in the cross-section of the wicking material observed by scanning electron microscopy (SEM). The wicking region may comprise a wicking surface formed on one or more interior walls of the process microchannels or liquid channels. The wicking surface may comprise one or a plurality of grooves formed in one or more interior walls of the liquid channels. The grooves may be formed in the wall separating the liquid channel and the next adjacent process microchannel and/or heat exchange channel. The grooves may be used to assist with liquid capture and/or enhance heat transfer. The grooves may be straight or have tortuous configurations. The grooves may have serpentine configurations. The grooves may be tapered. The grooves may be hemispherical. The grooves may be formed using any suitable technique including etching, sawing, electrodischarge machining, etc. The grooves may be of any length. The grooves may have a depth of about 1 to about 1000 microns, and in one embodiment about 10 to about 500 microns. The grooves may have a width of about 1 to about 1000 microns, and in one embodiment about 10 to about 100 microns. The number of grooves in the wicking region may be in the range from 1 to about 1000 grooves per centimeter as measured across the widths of the grooves, and in one embodiment from 1 to about 100 grooves per centimeter. In one embodiment, the grooves may have a constant or decreasing width from the top to the bottom of the grooves. In one embodiment, the grooves may form a mouth to larger diameter pores for liquid transport. Liquid may migrate through the grooves as a result of capillary flow. The flow of liquid in the grooves may be parallel (co-current or counter-current) or tangential (cross-current) to the flow of vapor in the adjacent process microchannels. The grooves may be oriented to direct the flow of liquid within the liquid channels and/or direct the flow of liquid between microchannel distillation sections. The grooves may be used to manifold the liquid from one microchannel distillation section to another microchannel distillation section. The microchannel distillation sections may be connected through the grooves in parallel or series, upstream or downstream from one another.

[**0157**] In one embodiment, the wicking region may comprise a wick positioned within the process microchannel or the liquid channel and a wicking surface (e.g., grooves) formed in one or more of the interior walls of the process microchannel or liquid channel.

[**0158**] In one embodiment, the wicking region may comprise a wire mesh that is resistance welded to the interior surface of a process microchannel or liquid channel wall (**FIG. 27**).

[**0159**] In one embodiment, the wicking region may comprise a plurality of thin, laser etched or otherwise formed channels that can be formed in shims used in making the process microchannels for the microchannel distillation units (**FIG. 28**).

[**0160**] In operation, the wicking region may be filled with liquid. When wet or saturated, the wick transports liquid through porous flow passages to a lower pressure zone, such as a lower pressure created by suction.

[**0161**] Punctured and punctured/expanded foils may be used as the wicking material in the wicking region and/or as capture structures. Useful foils include Ultra Thin Micro-Grid Precision-Expanded Foils, available from Delker Corporation. These materials are made in a flattened form and